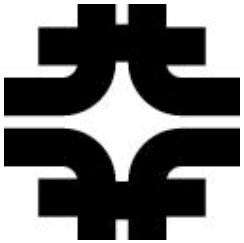
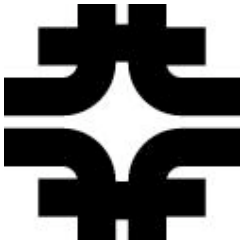


IO R&D LHC perspecitve

D. Petravick

Fermi National Accelereator Lab

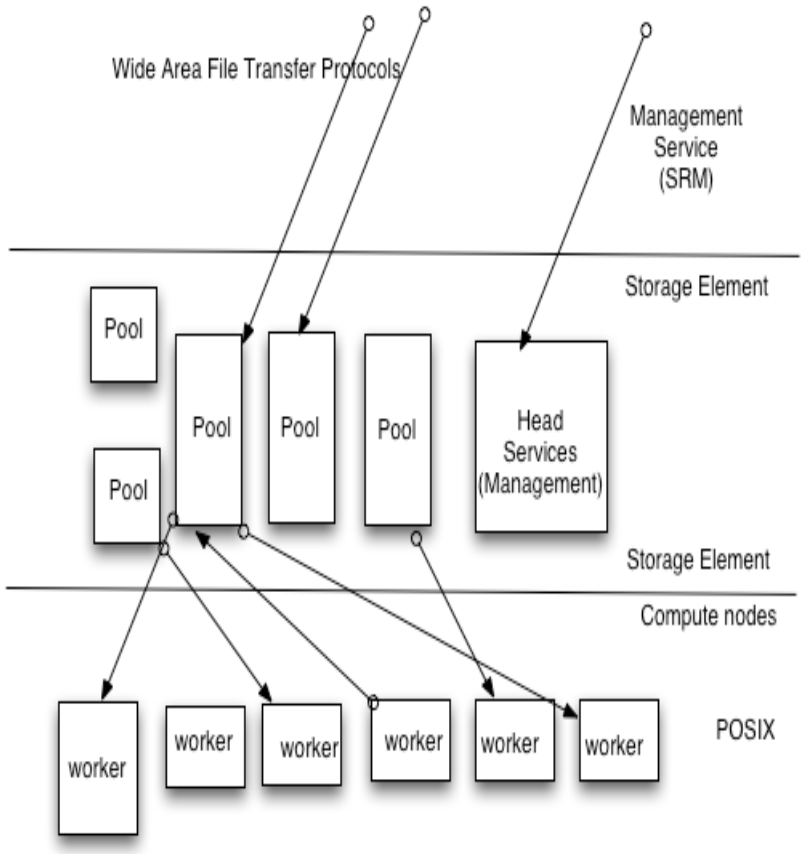


Overview

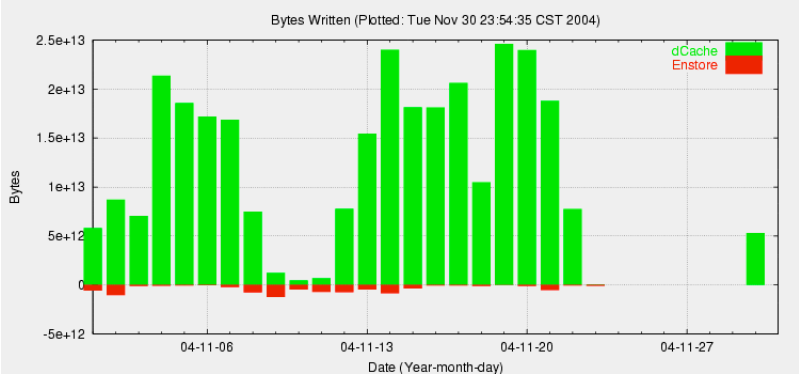
- HEP is an statistical science that studies particle collision event records < 1 MB containing records of a few KB.
- HEP DM systems deals with distilling, ordering records, partly for efficient access.
- HEP I/O
  - is multi stream capacity IO.
  - "file systems" are community written.
  - IDE, Linux, IP SAN, WAN
  - World wide interoperation requirements (LGC grid)

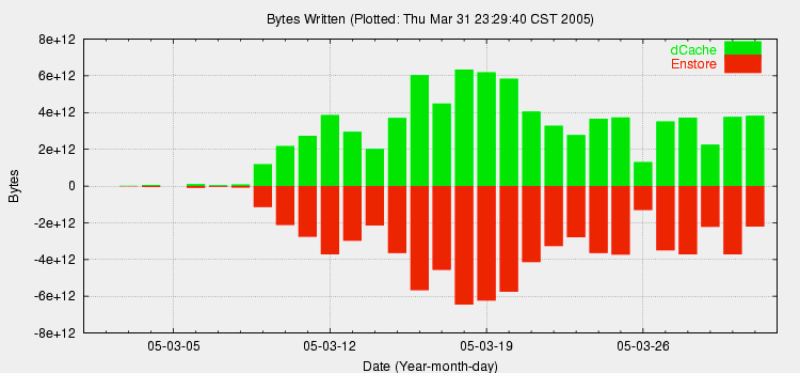
OSG Storage element

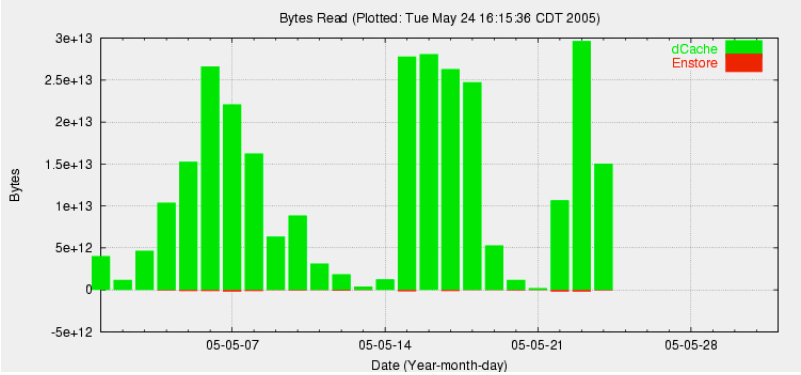
- Storage Resource Manager interface.
  - storage space management
  - data movement resource management
- File transfer protocols (GridFTP as "lingua franca")
- POSIX-like IO on the worker nodes.

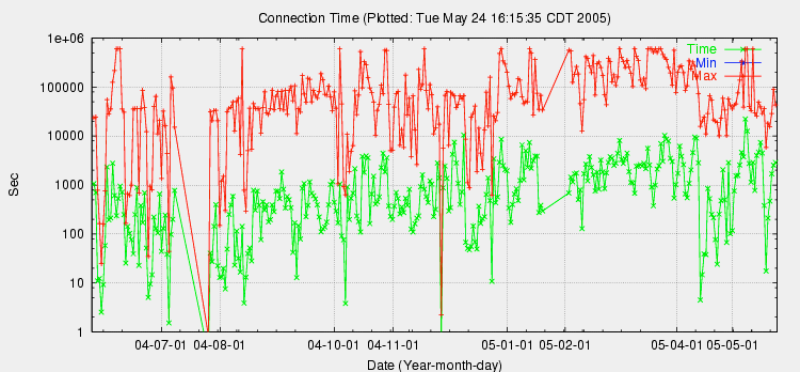


SE performance

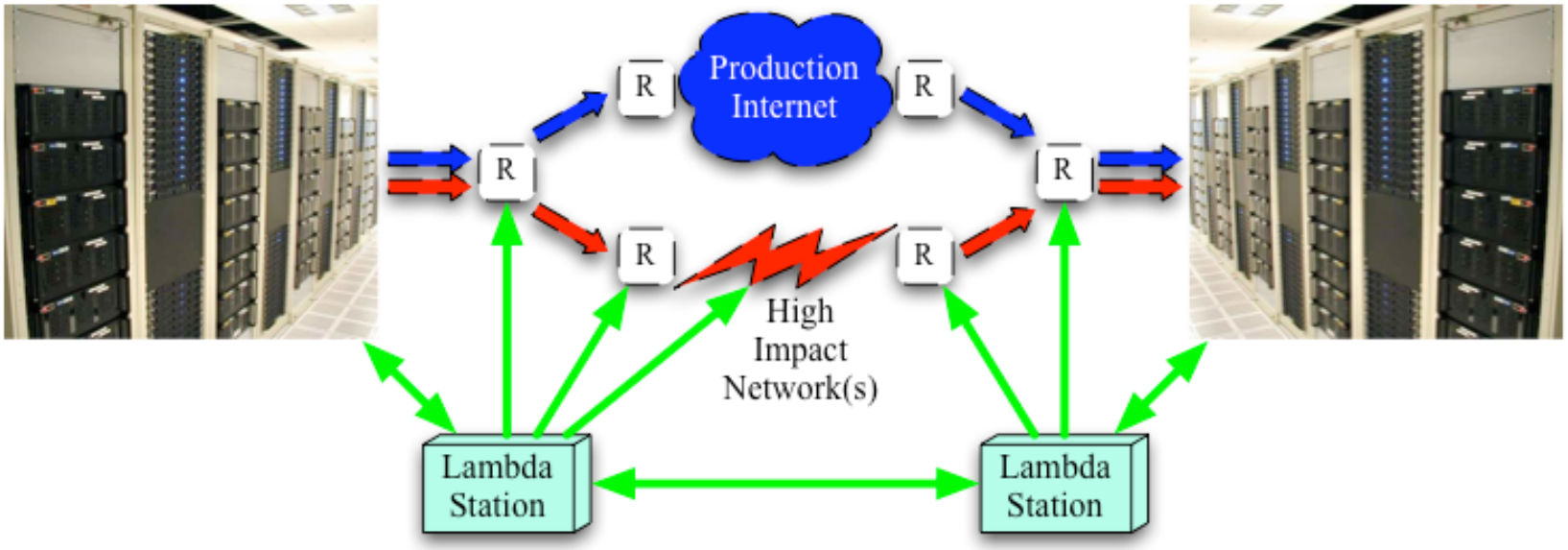


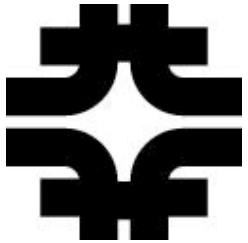






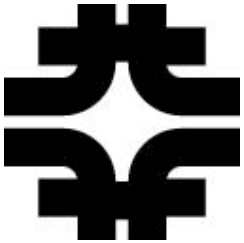
Practical Integration





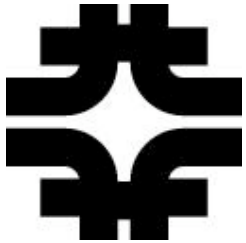
R&D topics (1)

- Integration to Wide Area.
  - Including ckt oriented "high impact" networks.
    - At large bandwidth*delay, (worldwide)
    - Retaining commodity last mile.
  - Service controlled firewalls, service informed IDS,
  - "VO perimeter"
- Internal scheduling (Data movement)
  - IP based SAN --> shaping to reduce last port congestion.
  - kernel resources for TCP @ large latency
  - (yet more) automatic replication for performance.



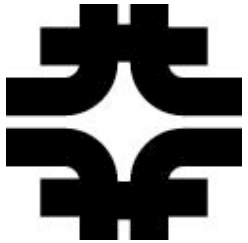
R&D Topics(2)

- Grid/Batch Systems R&D
  - Proper interface to upper level including grid batch schedulers.
    - Manage Storage Space (e.g. n-file transfer will complete)
    - Manage data movement resources.(do not always start service on request)
- Scale-breaking wide area interactive use.
  - Multi terabyte transactions in under an hour.
  - Interactive data sharing.



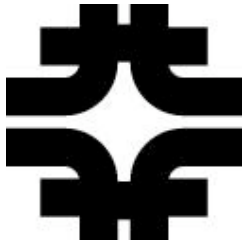
R&D (3)

- Standardize (or at least articulate deviants)
  - – Subset POSIX I/O apropos for write-once files.
  - + Added interfaces for prestage, pin, groupings…
  - + Relaxed timings for file systems meta-data --
    - allow for more easliy scalable name spaces, etc.
  - +Communicate User Behavior Assertions (e.g. not too many small files)
  - + X509 + GRID permission model.



R&D topics (4)

- Reliability and fault detection.
  - HEP's lust for commodity equipment implies storage system detects, mitigates faults in disk/kernal file systems, etc.
- True SAN
  - Infiniband potential for commodity non IP SAN.



R&D Topics (5)

- Novel Storage Devices
  - Tape as the basis for a permanent archive.
    - Performance of tape induces a streaming requirement that is not naturally in the problem.
    - Tape -- love it or leave it?
  - Small (random) object IO, memory in the storage hierarchy I.E. access w/ file system metaphors)? HEP data is Object oriented w/potentially very small gain-size
    - Performance of disk induces a streaming requirement which is not naturally in the problem.
    - Disk -- love it or leave it?